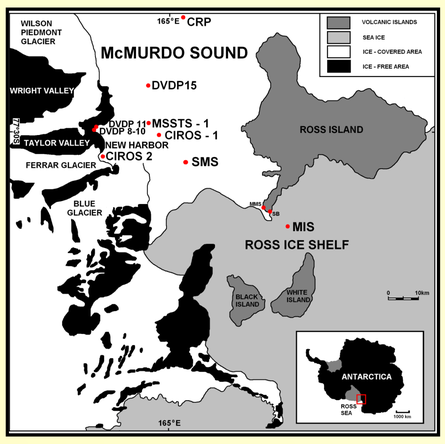
Dissolution of ossicles from the ophiuroid *Ophionotus victoriae* in Explorers Cove, Antarctica: implications for the Antarctic marine fossil record

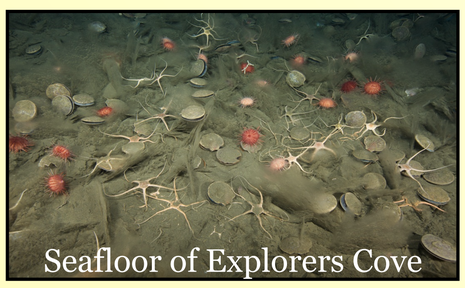
WALKER, Beverly J. (beverly.j.walker@vanderbilt.edu)[1]; **MILLER, M.F.**[1], and **BOWSER, S.S.**[2]

1. Earth and Environmental Science, Vanderbilt University, Nashville, TN, USA
2. Wadsworth Center, New York Department of Health, Albany, NY, USA



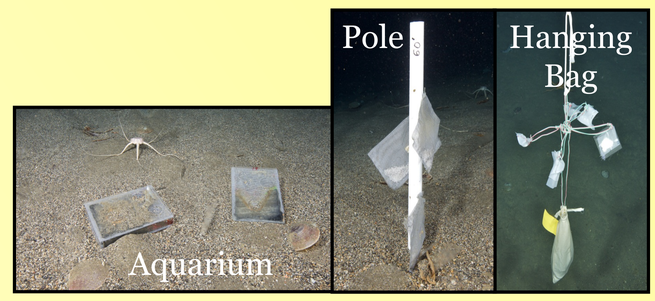
INTRODUCTION

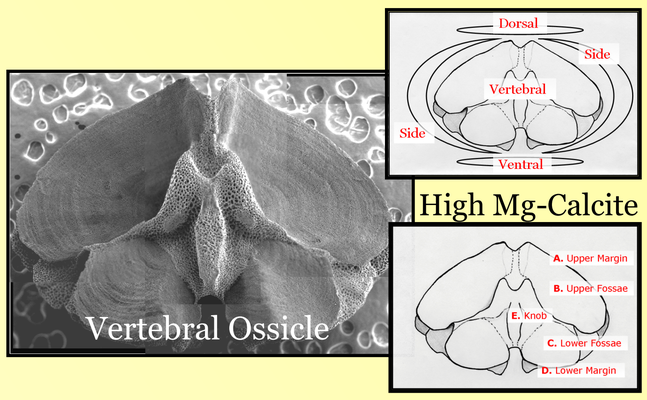
- Explorers Cove (77 ° 34'S, 163 ° 31'E)
- Water: -1.9C, 8.2 pH, oligotrophic, multi-year sea-ice coverage
- Over 6,000m of sediment cores (Antarctic Cenozoic Record) lack brittlestar record
- Antarctic brittlestar appearance 35mya
- Internal skeleton is composed of *ossicles*
- Vertebral ossicles are most resistant to dissolution: should be in sediment cores



EXPERIMENTAL SETTINGS

- Two year *in situ* exp., whole brittlestar: Aquarium and Poles
- One month *in situ* exp., freed ossicles: Hanging Bag
- Dissections of *Ophiosparte gigas*
- Sediment Search in short core from Explorers Cove

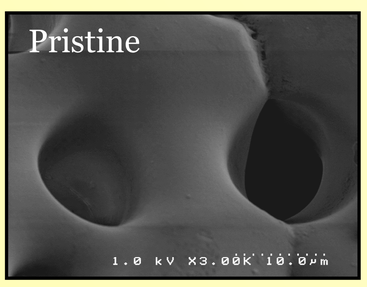




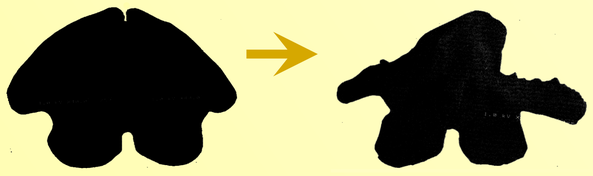
GOALS

- Assess taphonomic damage on brittlestar ossicles.
- Investigate the rate at which taphonomic processes occur.
- Inspect short sediment cores for presence or absence of ossicles.

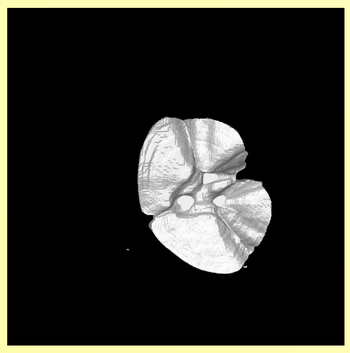
METHODS



Chemical Dissolution
- Scanning Electron Microscope images
- Scale shown above, with increasing damage to the right
- Example of Pristine stereom to the left



Silhouette Area Loss
- Allometric Relationship (central height to silhouette area)
- Proxy for estimating loss of physical area

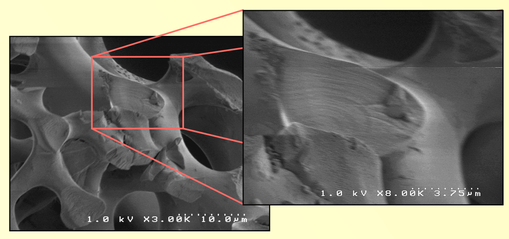


Porosity
- X-ray tomography
- IDL Routines analysis gives 3-D reconstructions
- Calculated porosity from reconstructions

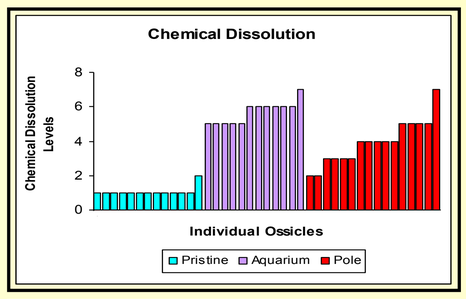
Dissections
- Digestion does not increase damage
- Pristine chemical dissolution mean = 1.08 ± 0.28
- Dissections chemical dissolution mean = 1.25 ± 1.22

Hanging Bag
- 27 days
- Weight loss: 0.07wt% - 1.31wt%
- Complete dissolution: 6-110 years
- Above SWI: potential underestimation of rate of dissolution

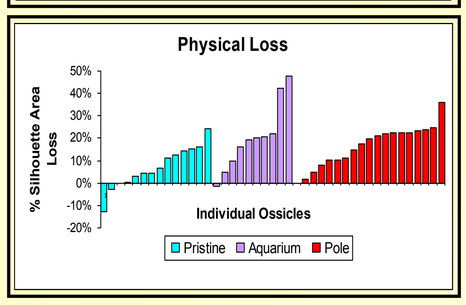
RESULTS



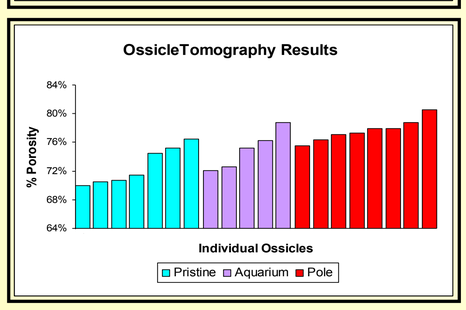
Thin laminations (Biomineralization?)
- Flat surfaces
- Inner sides of holes
- Peeling pattern



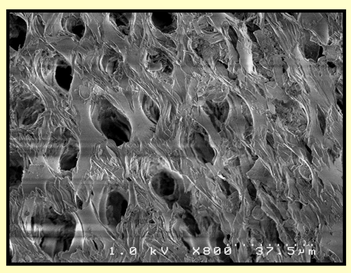
Aquarium > Pole
Pristine mean = 1.08 ± 0.28
Aquarium mean = 5.67 ± 0.65
Pole mean = 3.94 ± 1.9

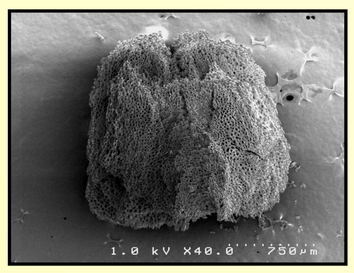


Aquarium > Pole
Pristine mean = 6.9% ± 9.5%
Aquarium mean = 20.2% ± 15.2%
Pole mean = 16.7% ± 9.2%



Aquarium < **Pole**
Pristine mean = 73.8% ± 0.04%
Aquarium mean = 74.4% ± 0.02%
Pole mean = 77.7% ± 0.02%





Sediment Search
- Single vertebral ossicle found in sediment core
- 6cm below SWI
- Highly dissolved

CONCLUSIONS

- Rapid Dissolution: features form within 2 years
- More rapid dissolution at the sediment-water interface
- Microbes potentially altering pore water chemistry at SWI
- Ingestion does not affect ossicle dissolution, but increases soft tissue decay
- Ophiuroids are misrepresented in the sediment cores and fossil record

ACKNOWLEDGEMENTS

Special Thanks to Steve Clabuesch, Cecil Shin, Shawn Harper and Henry Kaiser for underwater work and support; Raytheon Polar Services for logistical support; and National Science Foundation under grant #0739496.